

The Interagency Reservoir Assessment Program (BOR Western Reservoirs)

Introduction

The Interagency Reservoir Assessment Program was initiated in 1999 as a cooperative program between the United States Geological Survey (USGS) and Bureau of Reclamation (BOR) designed to meet BOR information needs on water quality issues in western reservoirs. The program is structured such that BOR regional representatives identify potential studies on water quality related issues at various reservoirs based on established criteria. These studies are prioritized and presented to the USGS as ongoing or new needs. Projects are initiated based on research capabilities at the USGS Western Fisheries Research and Columbia Environmental Research Centers and available funding. USGS scientists prepare study plans and conduct the research working in close association with local BOR personnel. To date projects have been initiated in eight western states and four projects were completed. The research conducted has been varied and effort has been made to select projects that have applicability to other programmatic areas. Projects include research on the following issues:

- Endangered species
- Mercury contamination
- Hydrogen sulfide emissions
- Gas supersaturation
- Water quality and eutrophication
- Environmental contaminants
- Seleniferous discharge

Examples of Specific Studies

Klamath Basin, Oregon

Severe water quality problems in the Upper Klamath Basin have led to increased concerns in the region to meet the needs of endangered species, tribal trust responsibilities, and irrigated agriculture. The USGS has been conducting biological studies in the Klamath Basin since 1991. Most of our research activities have focused on adult populations of Lost River and shortnose suckers (Fig. 1) in Upper Klamath Lake and surrounding tributaries. In 1998, biological studies were suspended due to logistical and funding considerations. In 1999, a permanent Field Station was established with funding from the Interagency Reservoir Assessment Program to support BOR and other Department of Interior agencies information needs in the Klamath Basin. In 2002, the USGS conducted research on adult sucker populations, adult sucker behavior with respect to water quality conditions, and juvenile sucker habitat use in Upper Klamath Lake.

The U.S Fish and Wildlife Service (FWS) identified these research requirements in its recent Biological Opinions for the upper basin. In response the USGS is working closely with local BOR personnel and has entered into cost-sharing agreements with BOR to conduct this research. Information collected is used by resource managers for both the BOR and FWS and to improve our understanding of a complex ecosystem.



Figure 1. Monitoring of sucker shoreline spawning areas in Upper Klamath Lake, OR is a component of the long-term monitoring program in the Upper Klamath Basin.

Fort Cobb Reservoir, Oklahoma

The USGS has conducted studies at Fort Cobb Reservoir, OK (Fort Cobb) at the request of BOR because of long-term eutrophication due to impacts of various agricultural activities. The Bureau asked for this information to determine the long-term sustainability of water quality in the reservoir; to determine potential sources of nutrient inputs to the reservoir; and to develop any necessary management plans to maintain the quality of water in the watershed surrounding the reservoir. The Fort Cobb study was designed to evaluate the current nutrient and water quality status including bacteria, algal toxins, and metals in the reservoir. Results of studies have indicated that Fort Cobb is a highly eutrophic reservoir. Algal toxins measured in the reservoir are low, measuring approximately 30% of the World Health Organization's Level of Concern. Four tributaries to the reservoir have been studied and all are sources of nutrients and bacteria to the lake. *E. coli* numbers are generally rapidly attenuated in the reservoir with decreasing concentrations as one proceeds down-reservoir to the dam and the water intake structure for the city of Anadarko, OK. An exception to this, however, is a large winter increase in *E. coli* due to staging of migratory waterfowl in the reservoir. These peak level

correspond to detections of *E. coli* in drinking water at the Anadarko Water Plant. These findings are being transferred to the BOR, the Environmental Protection Agency (EPA), and the State of Oklahoma for development of a long-term watershed management plan to protect critical water supplies.

Grand Coulee Dam, Washington

Fish kills have occurred in the reservoir below Grand Coulee Dam (Fig. 2) due to total dissolved gas supersaturation (TDGS), which occurs when water cascades over a dam or waterfall. The highest TDGS occurred after spilling water via the outlet tubes at the dam, though water with TDGS typically occurs above the dam as well. Exposure to water TDGS can cause gas bubble disease (GBD) in aquatic organisms. The disease, analogous to 'the bends' in human divers, can range from mild to fatal depending on the level of supersaturation, species, life cycle stage, condition of the fish, water depth, and the water temperature. The USGS, Columbia River Research Lab has conducted both field and laboratory experiments to determine the relative risks of TDGS to various species of fish in the reservoir below the dam. These data will enable sound management decisions regarding the effects of TDGS below Grand Coulee Dam as well as other BOR reservoirs.



Figure 2. Water spilled at Grand Coulee Dam can cause elevated levels of total dissolved gasses in the water and have negative impacts to fish below the dam. (BOR photo)

Elephant Butte Reservoir, New Mexico

Elephant Butte and Caballo Reservoirs are managed by the BOR and comprise the major water storage facilities on the Rio Grande Project for use in Texas and Mexico. Both Elephant Butte and Caballo Reservoirs are characterized by eutrophic conditions that exacerbate water quality concerns related to noxious algae blooms and elevated mercury concentrations in fish. In recent years the hypolimnetic discharge from Elephant Butte Reservoir has contained high concentrations of hydrogen sulfide that has destroyed a

quality tail-water trout fishery and caused localized human health concerns. In response to recent litigation, a greater proportion of water from these reservoirs is apportioned for municipal water supplies. Municipal water use, together with changing climatological variables, has caused in changes in reservoir withdrawals and has resulted in much lower water levels in Elephant Butte Reservoir. Lower water levels in the reservoir have caused further impacts on water quality of the reservoir as unconsolidated sediments in the upper reservoir are exposed and re-suspended by the river. Nutrient, phytoplankton, and water quality profile data have been collected from Elephant Butte and Caballo Reservoirs for 4 years (Fig. 3). In addition, hydrogen sulfide, selenium and mercury have been measured. The information derived from these studies will answer pertinent questions regarding the trophic status of the reservoirs and resulting changes in contaminant cycling. Results will be used by water managers and planners that are charged with maintenance and delivery of potable water to the citizens of El Paso and other water users in the Lower Rio Grande Basin.



Figure 3. A USGS scientist collects a sediment core sample from Elephant Butte Reservoir as part of a comprehensive water quality study.

Program Summary

The Interagency Reservoir Assessment Program is very effective at meeting BOR information needs on a variety of biological and water quality related issues. In addition the program has increased collaborative efforts between BOR and USGS and has led to additional partnerships outside the original scope of several projects. The information derived from these studies is helping to answer pertinent questions to improving BOR operated facilities conserving natural resources, and enabling managers to make sound decisions.

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